

University of Sargodha

ADP/BS 2nd Semester (F-24) Examination 2025

Subject: Mathematics

Paper: Calculus-II (MATH-5103/MATH-5104)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Find the formula for n th term of the sequence $1, -1, 1, -1, 1, \dots$
 - Evaluate $\int \frac{dx}{\sqrt{2x-x^2}}$.
 - Express $\sin x^2$ as power series.
 - Define monotonic sequence.
 - Evaluate $\int \frac{dy}{4+y^2}$.
 - Define limit comparison test for series.
 - Define ellipse.
 - Determine the convergence and divergence of the series $\sum_{n=1}^{\infty} \frac{n^2}{2^n}$
 - Define parametric curve.
 - Write the Cartesian equivalent form of equation $r^2 \cos \theta \sin \theta = 4$.
 - Find the foci of ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$.
 - Define bounded above sequence.

Subjective Part (3*12)

- Q.2. a) Find an equation of the tangent to the curve $x = t^3 + 1, y = t^4 + t$ at the point $t = -1$ corresponding to the value of parameter.
b) Sketch the curve by using $x = 3t + 2, y = 2t + 3$ and eliminate the parameter to find Cartesian equation of the curve.
- Q.3. a) Find the length of the astroid $x = \cos^3 t, y = \sin^3 t, 0 \leq t \leq 2\pi$.
b) Find the area under the one arc of the cycloid $x = r(\theta - \sin \theta), y = r(1 - \cos \theta)$.
- Q.4. a) Find the value of x for which $\sum_{n=1}^{\infty} x^{2n} (n)^{2n}$ converges.
b) Apply the ratio test to determine $\sum_{n=2}^{\infty} \frac{1}{\sqrt{n}(\ln n)^3}$.
- Q.5. a) Find the eccentricity of hyperbola $8x^2 - 2y^2 = 16$. Then find and graph its foci and directrices.
b) Find the limit of the sequence $\left\{ \left(1 - \frac{1}{n^2} \right) \right\}$ if it is convergent.
- Q.6. a) Use any method to evaluate $\int x \sin^2 x dx$.
b) Evaluate $\int \frac{-2x+4}{(x^2+1)(x-1)^2} dx$ using partial fraction.

University of Sargodha

ADP/BS 2nd Semester (F-24) Examination 2025

Subject: Mathematics

Paper: Mechanics (MATH-5106)

Mechanics

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Explain the term composition of forces.
 - Define Lamy's theorem.
 - Explain the term analytical method of finding resultant of n forces.
 - What is the difference between centroid and center of mass?
 - Find center of mass of a thin uniform rod.
 - Define limiting friction.
 - Define cone of friction.
 - Explain the terms virtual displacement and virtual work.
 - Explain the term kinematics.
 - Explain the magnitude and direction of $\frac{d\vec{r}}{ds}$.
 - Define acceleration and displacement graphically in velocity-time graph.
 - Find distance covered by a particle in n th second if acceleration is constant.

Subjective Part (3*12)

- Q.2. a) Three forces P , Q , R acting at a point are in equilibrium, and the angle between P and Q is double of the angle between P and R . Prove that $R^2 + QP = Q^2$.
b) Three forces P , Q , R act along the sides BC , CA , AB respectively of a triangle ABC . Prove that if $P \sec A + Q \sec B + R \sec C = 0$, then the line of action of the resultant passes through the orthocenter of the triangle.
- Q.3. a) State and prove theorem of Pappus.
b) The radius of the faces of a frustum of a solid cone are 2ft. and 3 ft. and height of the frustum is 4ft. Find the distance of the center of gravity of the frustum from the larger face.
- Q.4. a) A thin uniform rod passes over one peg and under another, the coefficient of friction between each peg and the rod is μ . The distance between the pegs is a and the straight line joining them makes an angle β with the horizontal. Show that equilibrium is not possible unless the length of the rod is greater than $\frac{a}{\mu}(\mu + \tan \beta)$.
b) Find the tangential and normal components of velocity and acceleration.
- Q.5. a) A uniform rod of length $2a$ rest in equilibrium against a smooth vertical wall and upon a smooth peg at a distance b from the wall. Show that, in the position of equilibrium, the beam is inclined to the wall at an angle $\sin^{-1}(b/a)^{1/3}$.
b) A particle is projected vertically upwards. After a time t another particle is sent up from the same point with the same velocity and meets the first at a height h during the downward flight of the first. Find the velocity of projection.
- Q.6. a) Discuss linear motion of a body moving with variable acceleration.
b) Find range of a projectile on an inclined plane. Also find time of flight in this case.

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ADP/BS 2nd Semester (F-24) Examination 2025

Subject: Mathematics

Paper: Linear Algebra (MATH-5105)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Define dual space. Λ
 - Find the trace of matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.
 - Define zero vector in the set M_{nn} .
 - Is $W = \left\{ \begin{bmatrix} a \\ b \\ 1 \end{bmatrix}; a, b \in \mathbb{R} \right\}$ a subspace of $\mathbb{R}^3$?
 - Write $v = \begin{bmatrix} x \\ y \end{bmatrix}$ as a linear combination of vectors $v_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ and $v_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$.
 - Determine whether $S = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\}$ is a linearly independent set in $\mathbb{R}^2$?
 - If $W_1 = \{n \text{ by } n \text{ upper triangular matrices}\}$ and $W_2 = \{n \text{ by } n \text{ lower triangular matrices}\}$ are subspaces of a vector space $V = M_{nn}$. Find $W_1 \cap W_2$.
 - Define Linear Transformation.
 - Let $L: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be a linear operator, where $\dim(\text{Ker } L) = 1$, then find $\dim(\text{Range } L)$.
 - Find the eigenvalues of the matrix $\begin{bmatrix} 1 & -1 \\ 2 & 4 \end{bmatrix}$.
 - Define relation between $\dim V$ and $\dim V^*$.
 - Let V be the Euclidean space P_1 . If $p(t)$ and $q(t)$ are polynomials in P_1 , we define $(p(t), q(t)) = \int_0^1 p(t)q(t)dt$. If $p(t) = t + 2$, then find length of $p(t)$.

Subjective Part (3*12)

- Q.2. Use the Gram-Schmidt process to construct an orthonormal basis for subspace W of

Euclidean space $\mathbb{R}^3$ spanned by $\left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \right\}$.

- Q.3. Let $L: \mathbb{R}_4 \rightarrow \mathbb{R}_3$ defined by linear transformation

$$L([u_1 \ u_2 \ u_3 \ u_4]) = [u_1 + u_2 \ u_3 + u_4 \ u_1 + u_3].$$

Show that $\dim \mathbb{R}_4 = \dim \text{Ker } (L) + \dim \text{R}(L)$.

- Q.4. Find the characteristic polynomial, eigenvalues and eigenvectors of the matrix

$$\begin{bmatrix} 1 & 2 & -1 \\ 1 & 0 & 1 \\ 4 & -4 & 5 \end{bmatrix}.$$

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- Q.5. Consider the basis $\beta = \{(1,0), (0,1)\}$ and $\beta' = \{(1,1), (2,1)\}$ for $\mathbb{R}^2$, then find

a) Transition matrix from β' to β .

b) Transition matrix from β to β' .

- Q.6. State and prove the "Cauchy-Schwarz inequality".

University of Sargodha

BBA/BS/ADP 2nd Semester (F-24) Examination 2025

Paper: Exploring Quantitative Skills (URCG-5120)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Define inductive reasoning and give one example from daily life.
 - Define rational number with two examples.
 - What are set of Natural numbers, Whole numbers and set of integers?
 - Differentiate between rates and ratios.
 - Define profit and loss.
 - Distinguish between primary and secondary data.
 - Define factorial. What is factorial of 4.
 - In how many ways 7 books can be put on a shelf having capacity of 3 books at a time?
 - Write two axioms of probability.
 - Differentiate between absolute and relative errors.
 - Define Range in descriptive statistics.
 - Define Sample Space and Events.

Subjective Part (3*12)

- Q.2. Temperature of Sargodha city at 2.30pm is recorded for seven days. Observed temperature (in degree) is given as 48, 47, 43, 38, 46, 48, and 49. Find the mean, median, and mode of the data.
- Q.3. On an electricity bill for 392 units, 17500 cost is reported. How much electricity cost would be for 142 units using this information?
- Q.4. A man deposits Rs.100, 000 in a bank and bank agree to return 120400 after 2 years. Find the simple interest rate at which money is deposited.
- Q.5. A person purchases laptops for 10, 0000 PKR and sell these for 1170000. Find the profit value.
- Q.6. What is the probability of getting sum of greater than 8 when two dice are rolled once?

C.P

----- LK-7153/14-11-25 -----

University of Sargodha**BBA/BS/ADP 2nd Semester (F-24) Exam 2025****Paper: Fables, Wisdom Literature & Epic (URCG-5112)****Time Allowed: 02:30 Hours****Maximum Marks: 60****Note: Objective part is compulsory. Attempt any three questions from subjective part.****Objective Part (Compulsory)**

- Q.1.** Write short answers of the following in 2-3 lines each on your answer sheet. (2*12.)
- Define personification. Give example.
 - Who is the narrator in the fable *The Lion and the Bull*? → *Vishnu Sharma*.
 - Name the characterers of the poem *Sympathy*?
 - What challenges are faced by animals in *The Ring-Dove*?
 - What do the owls and crows symbolize in *The Owls and the Crows*?
 - What is the central theme of the poem *A Spider and a Fly*?
 - What is the squirrel's response to mountain's criticism? (*A Mountain and a Squirrel*)
 - What does the wave symbolize in the poem *The Wave of River*?
 - Differentiate between parable and fable.
 - Explain the Hikayat: *It is fruitless to celebrate the death of any enemy as one will never be spared from it either.*
 - What lesson does the Hikayat of seeking knowledge from the teachings of ignorants teach?
 - What is the relationship between Rustam and Sohrab in the epic *Rustam and Sohrab*?

Subjective Part (3*12)

- Q.2.** Write a note on the different themes explored by Firdausi in the poem *Rustam and Sohrab*.
- Q.3.** How does the bird's current situation in the cage contrast with its previous life in garden? Explain with examples from the text of *The Bird's Complaint*. OR discuss Alama Iqbal as a philosophical and mystic poet with special reference to the selected poem from *Bang-i-Dara (The Call of Marching Bell)*.
- Q.4.** How do the fables of Bidpai address the social and ethical issues and what impact do they have on modern readers?
- Q.5.** Discuss the relevance of Hikayat e Sadi to contemporary society and how can their teachings be applied to moral, ethical, social and personal issues.
- Q.6.** The story of Rustam and Sohrab epitomizes tragic irony and inexorable working of fate. Discuss.

University of Sargodha

BBA/ADP/BS 2nd Semester (F-24) Examination 2025

Paper: Science of Society-I (URCG-5116)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1.** Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Define 'Sociology'
 - Define 'Political Science'.
 - Define 'Gender'.
 - What is 'Social Class'?
 - Define 'Cultural Change'
 - Write two functions of Modern State.
 - Define 'Globalization'.
 - Define 'Industrial Society'.
 - Define 'State'.
 - What is 'Race'?
 - Write two characteristics of 'Agrarian Society'.
 - Define 'Colonialism'.

Subjective Part (3*12)

- Q.2.** Define society. Discuss different types of society with their distinctive features.
- Q.3.** Discuss the nature and significance of culture. Also describe various types of culture.
- Q.4.** Define 'Socialization'. What are the factors play role in development of personality?
- Q.5.** Discuss difference between Sex and Gender. Explain the challenges of women participation in politics and economy of Pakistani society.
- Q.6.** Discuss any two social problems (issues) of Pakistani society and suggest some solutions.

University of Sargodha

BBA/BS/ADP 2nd Semester (F-24) Examination 2025

Paper: Pakistan Studies (URCG-5128)

Time Allowed: 02:30 Hours

(For All Programs)

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.
The students can attempt the whole questions paper either in English OR Urdu.

Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet.

(2*12)

- i. Two Nation Theory.
- ii. Lahore Resolution.
- iii. First President of Pakistan. *Ayub Khan*
- iv. Plateaus of Pakistan.
- v. Indus Valley Civilization.
- vi. Climatic Regions of Pakistan.
- vii. GDP.
- viii. First Defense Minister of Pakistan.
- ix. First Martial Law.
- x. What do you know about the Pakistan National Alliance (PNA)?
- xi. Who is the author of "The Struggle for Pakistan"?
- xii. What do you know about the Kargil conflict?

Subjective Part (3*12)

- Q.2. Discuss in detail the military interventions and democratic transitions in Pakistan.
- Q.3. Analyze the evolution of Muslim nationalism in British India.
- Q.4. Discuss in detail the economic challenges of Pakistan.
- Q.5. Write a comprehensive note on the Kashmir issue.
- Q.6. Highlight the importance of Two Nation Theory in the creation of Pakistan.

----- LK-9290/17-11-25 -----

یونیورسٹی آف سرگودھا

بی اے / بی ایس / اے ڈی پی 2nd سمسٹر (F-24) امتحان 2025ء

پرچہ: سیرت النبی ﷺ (Seerat of The Holy Prophet (PBUH) (URCG-5127)

کل نمبر: 60

وقت 2:30 گھنٹے۔

نوٹ:- معروضی حصہ لازمی ہے۔ موضوعی حصہ میں سے صرف تین سوالات کے جوابات تحریر کریں۔

معروضی حصہ (لازمی)

سوال نمبر 1: درج ذیل سوالات کے مختصر جوابات تحریر کریں۔

(2*12)

1. حلف الفضول سے کیا مراد ہے؟
2. کو اکب پرستی سے کیا مراد ہے نیز کون سی قوم اس میں مبتلا تھی؟
3. ہجرت حبشہ اولیٰ کا حال مختصر لکھیے۔
4. نبی کریم ﷺ کے دعوتی خط کا جواب نجاشی شاہ نے کس انداز میں دیا تھا؟
5. وما ارسلنک الا رحمة للعالمین کا ترجمہ کیجیے۔
6. یثاق مدینہ اور مواخات مدینہ سے کیا مراد ہے؟
7. آپ ﷺ کا اسلوب تدریس درج کیجیے۔
8. نیک اور امانت دار تاجر کی فضیلت پر حدیث مہار کہ لکھیے۔
9. حدود اللہ سے کیا مراد ہے؟
10. حضرت ابراہیم علیہ السلام کی مکہ مکرمہ کے لیے کی گئی دعا کا مفہوم لکھیے۔
11. مصنفین کے نام لکھیے۔ الف) فیاء النبی ب) حرمة للعالمین
12. اشتراق کا مفہوم واضح کیجیے۔

موضوعی حصہ (3*12)

- سوال نمبر 2: عصر حاضر میں سربراہان مملکت کے لیے رہنما اصول سیرت النبی ﷺ کی روشنی میں لکھیے۔
- سوال نمبر 3: ساسانی اور حبشہ کی تہذیب کے سیاسی، معاشی اور مذہبی حالات قلم بند کیجیے۔
- سوال نمبر 4: مدنی عہد میں دعوت اسلام کے مراحل پر نوٹ لکھیے۔
- سوال نمبر 5: آنحضرت ﷺ بطور معلم مضمون قلم بند کیجیے۔
- سوال نمبر 6: قبل از بعثت آنحضرت ﷺ کی حیات طیبہ کے احوال قلم بند کیجیے۔

University of Sargodha

ADP/BS 2nd Semester (F-24) Examination 2025

Subject: CS/SE/IT

Paper: Linear Algebra (MATH-5102)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1.** Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Define characteristic equation.
 - If A is symmetric then show that $(A^{-1})^T = (A^T)^{-1}$.
 - For what value of K the vectors $(1, -2, K)$ in R^3 be a linear combination of vectors $(3, 0, -2)$ and $(2, -1, -5)$.
 - Show that $f_1 = 1, f_2 = e^x$ and $f_3 = e^{2x}$ are linearly independent by using the Wronskian.
 - If A is invertible matrix and n is nonnegative integer, then show that $(A^n)^{-1} = (A^{-1})^n$.
 - Show that matrix P is orthogonal if and only if P^T is orthogonal.
 - Show that matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ is zero of $g(x) = x^2 + 3x - 10$.
 - Find a & b , if $A = \begin{bmatrix} 1 & -1 \\ a & b \end{bmatrix}$, & $A^2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.
 - If B and C are both inverses of the matrix A , then prove that $B = C$.
 - Normalize the vector $v = (1, 2, 4, 5)$.
 - Consider the vector $u = (1, -5, 3)$ and find $\|u\|_\infty, \|u\|_1, \|u\|_2$.
 - Define Null space.

Subjective Part (3*12)

- Q.2.** (a) Compute the determinant of $\begin{bmatrix} 1 & 0 & 0 & 3 \\ 2 & 7 & 0 & 6 \\ 0 & 6 & 3 & 0 \\ 7 & 3 & 1 & -5 \end{bmatrix}$.
- (b) Show that the set $\{1, i\}$ in $\mathbb{C}$ is linearly independent over $\mathbb{R}$ but linearly dependent over $\mathbb{C}$.
- Q.3.** (a) Determine whether $(1, 1, 1, 1), (1, 2, 3, 2), (2, 5, 6, 4), (2, 6, 8, 5)$ form basis of R^4 . If not, find the dimension of the subspace they span.
- (b) Apply the Gram Schmidt process to transform the basis vectors $u_1 = (1, 1, 1), u_2 = (0, 1, 1)$ and $u_3 = (0, 0, 1)$ into an orthogonal basis and then normalize the orthogonal basis vectors to obtain an orthonormal basis.
- Q.4.** (a) Solve the system by Gauss elimination method
- $$\begin{aligned} 3x_1 + x_2 - x_3 &= -4 \\ x_1 + x_2 - 2x_3 &= -4 \\ -x_1 + 2x_2 - x_3 &= 1. \end{aligned}$$
- (b) Determine whether the vectors in R^4 are linear independent or linear dependent $(1, 3, -1, -4), (3, 8, -5, 7), (2, 9, 4, 23)$.
- Q.5.** (a) Consider the set $V = \mathbb{R}^n$ with standard addition and scalar multiplication defined as $rv = 0_v$ for any $v \in \mathbb{R}^n, r \in \mathbb{R}$, where $F = \mathbb{R}$. Check whether the set V over F forms a vector space or not?
- (b) Find Eigen values and bases for Eigen spaces of $A = \begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix}$.
- Q.6.** (a) If $A = \begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}$ then diagonalize that matrix.
- (b) Prove that the set $\{x + iy | x, y \text{ are real numbers}\}$ forms a Vector Space.